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Defining Organizational Measures for NAESU

by

Robert E. Boynton
Larry E. Vaughan

September 1998

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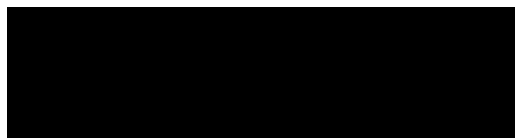
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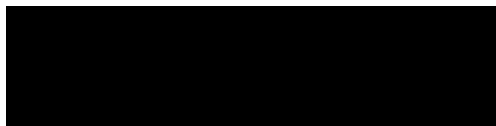


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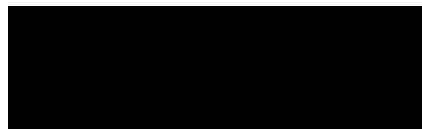
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13. ABSTRACT (Maximum 200 words.) This study examines factors relevant to the development of organizational measures of effectiveness for the Naval Aviation Engineering Service Unit (NAESU). NAESU's principal function is to provide training and assistance to enable Navy and Marine air units to operate , maintain, and repair assigned equipment. This is accomplished through engineering and technical personnel , commonly called ETS or tech reps , assigned to detachments co-located with military air units. This study was designed to enable NAESU to develop performance measures for its organizational components, i.e., DETS, regions and headquarters. The provision of tech rep services requires NAESU to assure tech rep competence , to provide internal support processes, and to facilitate tech rep interchanges with suppliers and customers. The report concludes with six recommendations for measuring organizational effectiveness in these areas.				
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SUMMARY

This study examines factors relevant to the development of organizational measures of effectiveness (MOE) for the Naval Aviation Engineering Service Unit (NAESU). It was commissioned by the Commanding Officer of NAESU.

In conducting the study, we had to consider the broad range of NAESU activities 'including: training personnel; evaluating systems, equipment and publications; recommending equipment and maintenance improvement; identifying training needs; and providing technical assistance to the operating forces. Discussions with tech reps led to the development of a list of nineteen products and services provided by NAESU. Discussions with various NAESU customers showed they had different opinions regarding NAESU functions in each of these areas. To deal with these differing perceptions we found it useful to divide NAESU customers into four categories: clients, senior level users, "T" level users, and "O" level users. We then surveyed these four broad groupings and asked participants to evaluate the nineteen products and services provided by NAESU. An analysis of the services and responses led us to conclude that it would be useful to cluster the nineteen services into four broad categories of training, advice, maintenance and liaison. We were then able to do some data analysis that provides a clearer picture of what customers expect from NAESU. This was necessary before a meaningful discussion of MOE's could be conducted.

Using a GAO report as a guide, we concluded that measures of economy and measures of effectiveness, as defined in the report, could be realistically applied to NAESU. Measures of productivity however, are not applicable to NAESU. Calculation of productivity measures such as quantity (input/output ratios), quality (according to standards), and cost (unit cost of output) are simply not feasible measures of NAESU activities. The input varies and is not predictable either as to quantity or degree of difficulty; output is not defined in quantitative measures and must reflect qualitative differences in the individual problems presented to NAESU for solution. Standards for the type of work NAESU does in the problem solving area do not exist; standards for teaching performance relate more to school house environments than to the on-the-job training provided by NAESU tech reps. Unit cost of output can not be calculated if the units of output can not be defined.

Measures of effectiveness involving client satisfaction, economic impact and contribution to objectives can be addressed, however. We recommend that customers and tech reps be sampled on a regular basis for an evaluation of NAESU performance. The results should be maintained in a database that would in itself become a valuable tool, indicating trends and changes in performance and perhaps providing advance warning of developing problems. Such an approach requires a more sophisticated understanding of effectiveness measures than that required when using measures of productivity.

The report concludes with six recommendations that focus on two roles of NAESU's organizational components. These roles include assuring the continuing competence of NAESU tech reps and creating internal and external structures that enable tech reps to provide needed products and services.

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DEFINING ORGANIZATIONAL MEASURES FOR NAESU

INTRODUCTION

Specialists, who may be DOD civilians, military personnel, or private industry contractors, provide engineering and technical services (ETS) to military technicians. The function of the specialists is to provide an on-call level of expertise above and beyond that available from within the military units. The Naval Aviation Engineering Service Unit, NAESU, provides ETS to the Navy and Marine Corp air communities. It does so through Detachments, assignments, or tech assists to various unit locations. How to measure the success of NAESU in performing this function is a question that both NAESU and NAVAIR wish to address.

PURPOSE

This study was commissioned by the Commanding Officer of NAESU. As budgetary resources became more scarce, he wanted to develop and define organizational measures that justified the need for the NAESU products and services and that indicated actions to be taken to achieve greater operational efficiency and customer satisfaction. Additionally, the Government Performance Review Act of 1993 mandated that government activities develop and use performance measures and implement benchmarking as standard management practices. This study is an effort to comply with the act and to develop relevant, useful measures.

BACKGROUND

The military departments operate under a philosophy that military personnel should be able to operate and provide basic maintenance for all equipment. The departments design technical training, skill development, and personnel, logistics, and management systems toward this end. Under this philosophy, civilians or contractors perform depot maintenance. "O" (operations) level maintenance and "T" (intermediate) level maintenance, if it exists, are the responsibility of military technicians.

The basic philosophy is to provide initial and advanced technical training in service schools and then put the newly trained military technicians to work in their assigned fields. The basic school graduate can be considered an apprentice. He or she will become a journeyman

through a combination of experience, on-the-job training, mentoring by more experienced military personnel, and attending specialty schools. For this process to be effective requires that all elements of the logistics functions work at full efficiency. Due to the random nature of some of the processes, military technicians seldom are able to attain or maintain a sufficiently high level of competence without the assistance of engineering and technical services. DOD civilian, military or contractor personnel, known as ETS or tech reps, provide these services. They assist military technicians in the installation, modification, operation, and maintenance of equipment and systems. The services generally take the form of advice and training, although direct performance of maintenance may be performed occasionally. The tech rep involvement in these inter-relationships is illustrated in Figure 1.

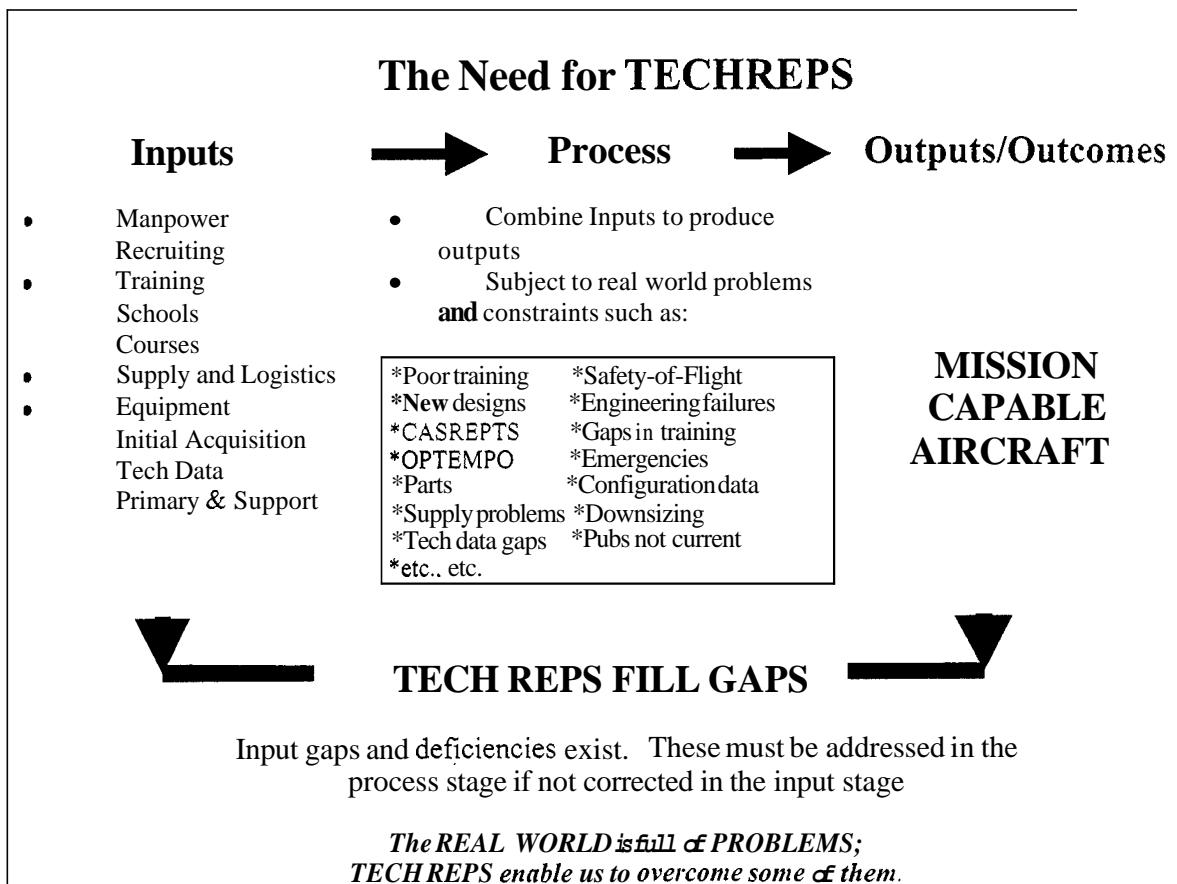


Figure 1.

Although the primary purpose of Engineering and Technical Services is the provision of training, tech reps perform a broad range of activities that include: training personnel, evaluating

systems, equipment and publications, recommending improvements, identifying training needs, and providing technical assists to the operating forces. The Federal Acquisition Regulation (FAR.) includes Engineering and Technical Service as a sub-set of Part 37.2 - Advisory and Assistance Services. Additionally, NAESU provides contract and technical oversight of Foreign Military Sales (FMS) Contractor Engineering Technical Services (CETS) and Contractor Maintenance Services (CMS). The performance of NAESU in these areas is not a part of this study.

The Defense Business Operating Fund Handbook (replaced by Working Capital Funds) stated that "performance measures are quantitative expressions of the success of achieving a specific objective... Successful performance means that the provider's products or services must: be what the customer needs; be available when the customer requirement exists; and, consume the least amount of limited DOD resources... Providers are required to describe their performance measures for the categories of timeliness, quality, and customer satisfaction... Timeliness measures are typically expressed as average days it takes for a customer to receive a product or services... Quality measures... are typically expressed as the number of defects in the product... or number of customer complaints recorded. Customer satisfaction is a measure of how well provider output conforms to customer expectations...(it) is best measured through direct contact with customers."

Technical representative services are by their nature qualitative. The development of measures of effectiveness is doomed if one seeks only production-oriented measures. The issues of timeliness and customer satisfaction seem to be the most important considerations in evaluating the effectiveness of tech rep organizations. Recognizing the difficulty in developing traditional industrial measures, we chose to focus on what it is that tech reps provide to an organization. Analyzing what they provide and what customers want would help us address the issues of timeliness and customer satisfaction as indicators of NAESU performance. In performing this study we were interested in organizational performance measures for NAESU Headquarters, Detachments, and Regions, not the performance of individual tech reps.

STUDY APPROACH

Performance measurement is commonly instituted to serve as the basis for strengthening accountability or for resource allocation. The performance measurement system should be embedded into the ongoing management process so the measures can be used in strategic planning, operational planning, operational control, program evaluation, and manager/personnel performance evaluation.

The use of performance measures varies by level in the organization. At the outcome level, strategic or executive level measures should provide information on the achievement of strategic goals, overall level of customer satisfaction, and outcome evaluation. At the output level, middle management measures should provide information on the stability of the organization processes, contribution to the strategic goals, areas of resource shortage, and value added by various activities and outputs. Finally, at the process level, operational measures should provide information on the balance of organization processes and quality control. At all levels, areas to be examined include customer satisfaction, employee satisfaction and productivity.

The development of performance measures for an organization must respond to several considerations: What characteristics of the organization's activities are to be measured? What kinds of performance indicators should be used? How are the measures to be obtained? What is the priority of the different activities?

In general, classes of productivity/performance indicators for organizations are concerned with the following: *efficiency, effectiveness, timeliness, productivity, quality, innovation, quality of work life, and financial performance.*

In our opinion, *efficiency and productivity* are not applicable to tech rep activities and *financial performance and quality of work life* are of questionable relevance. *Efficiency* is measured as a unit of output per unit of time, money, or other resource; *productivity* is typically measured as standard output per unit of time. ETS provides a differential output in response to variable situations and therefore *efficiency and productivity* would not be valid performance indicators. *Quality of work life* is the result of a large number of factors, including aspects of the **work** environment that are not under **NAESU** control. However, some measure of job satisfaction or work environment should be included. *Financial performance* is typical of private, not public

sector, organizations. It could apply to the cost-savings aspects of some tech rep activities, such as fixing items that would otherwise incur the large costs of depot repair, salvaging materials or other activities that result in significant future cost reduction. This however, is difficult to apply. Even when the savings far exceed the cost of the tech rep, the savings are not in the same budget categories and are not managed by the same organization. NAESU manages the tech rep costs, but the customer manages the savings.

For performance measures to be most meaningful, they should be crafted to fit the environment in which the organization operates. In characterizing ETS, key issues include the level and sources of uncertainty in their environment, such as:

- Customer-related uncertainties tied to the number and qualifications of the personnel assigned to a unit, e.g.:
 - Is the unit staffed with the correct number and rank of personnel? A typical squadron is generally undermanned and has 30% or more turnover in its personnel each year, providing an atmosphere of continual change.
 - How qualified are the junior military technicians? Have they received the schooling appropriate to the position? More extensive training of first-tern enlistees prior to unit assignment may not be cost-effective; about 60% of them will be gone by the end of their enlistment. Have they had the opportunity to use their training before it is forgotten? Newly assigned personnel are often diverted for months to other duties before assuming their assigned technical position, seriously reducing the carryover from training to job.
 - Are the senior personnel experienced in the system and able to teach and assist the junior personnel? Where closed-loop Detailing is not used, senior enlisted personnel may not be experienced in the currently assigned systems and may be unable to provide expertise for the junior technicians. To be promoted, personnel must have experience at both "O" and "T" levels. Because these jobs are vastly different, the rotation reduces the ability of the senior to mentor the junior.
- Task-related uncertainties tied to the equipment, e.g.:
 - Are forthcoming weapon system changes or modifications beyond the experience and skills of assigned operating and maintenance personnel? Lacking funds for

major procurements, the services are making continuous incremental changes in equipment the norm for technological modernization.

-Are forthcoming test equipment or procedure changes beyond the experience or skills of assigned personnel?

-How radical and pervasive are the changes? The greater the changes, the greater the need for tech rep services.

Additionally, how the customer organization balances the conflicting objectives of capability improvement (training function) and product/process operation (maintenance function) greatly affects what is expected of tech reps. Organizations also vary in terms of emphasizing long-term or short-term improvement in the organization's capability. There appears to be a bias in favor of the short-term, this week or next, in order to process current work and meet flight hour and up-time expectations. It is likely that few people in power in the squadrons and air stations **are** very concerned about the long-term, next year and beyond. A number of users expressed concern and interest in the medium-term, an upcoming work-up or deployment, for example. This focus arises because the organization will be placed in a situation where it is almost totally reliant on its internal personnel, because ETS generally do not deploy.

In the private sector, the customer is typically both the receiver and purchaser of a good or service. In the public sector, the receiver and purchaser (provider of funds) are typically different persons or organizations. This requires that the "customer" be more carefully defined. For purposes of this research, we will define two sets of customers.

The first customer is the user, defined as the person (including an organizational representative) who actually receives the ETS products or services. Examples include pilots and military technicians receiving training, squadron and wing commanding officers and maintenance officers, and CFAs or schools that receive reports. As used in this report, a user is a customer of NAESU who receives specific products or services from one or more tech reps. Products and services include, but are not limited to, training, advice, reports, recommendations, repair, documents, or parts.

The second customer is the client, defined as an organization or person who provides the resources, principally money and manpower positions, to obtain ETS. Examples include NAVAIR, PMAs, APMLs, NAWC, ASO, depots, and type or fleet commanders. Specifically, we

define a client as a customer of NAESU that approves ETS requests, justifies funding requests, allocates funds or positions to NAESU, or assigns funding priorities to ETS requests.

STUDY METHODOLOGY

We assume that tech reps, clients and users know what they want from NAESU, and that this information would point to performance measures. In an earlier project (Boynton, 1995), we collected a list of 79 work activities that ETS said they performed. Because there was much duplication showing up under different names, we asked participants at the 1994 NAESU OIC conference to review the 79 activities. Working in small groups of about six people, they discussed and clustered the activities. We used their clusters to develop a new list of 28 ETS activities. We then asked ETS and CETS at NAS Lemoore and NAS Brunswick to work on those groupings and were able to reduce the list to **19** activities. This sorting lists the products and services that ETS provide and excludes activities that, although necessary, do not directly produce products or services. These different lists are included in the report appendix.

We then used a combination of interviews and questionnaires with users and clients to elicit information regarding the 19 ETS activities, services or products they were receiving from NAESU. By comparing what customers expect and what ETS are actually doing, we hoped to infer the types of measures most pertinent to NAESU Headquarters, Regions and Detachments (DETs) as providers of ETS. Participants were asked to rate the importance of each service or product and then to grade the quality of the service or product they received. For particularly high or low marks we asked for the criteria used to make the quality evaluation. The survey form is included in the appendix.

We also observed and participated in some NAESU on-site ETS reviews. Since requests for the assignment of ETS exceed the positions and funds available, reviews are held each spring to develop and assign priorities to a list of desired ETS requests or tasks for the next fiscal year.

SAMPLE CHARACTERISTICS

Our customer survey responses include 88 persons. There are eighteen civilian and military *clients*, primarily NAESU program managers and NAVAIR APMs. Analysis of the

responses of the 70 users revealed apparent differences in their views. Based on these differences, we have defined three classes of users - *senior users*, *"I" level users*, and *"O" level users*.

There were **14** *senior users*, mostly maintenance officers and maintenance master chiefs **E9** to **O5**, from NAS Lemoore, NAS Miramar, and NAS North Island. There were **42** *"I" level users* from NAS Lemoore, and NAS Miramar. These were principally **E3** to **E9**, in AE, AT, and AM ratings, but included four officers. The *"O" level users* included **14** respondents from NAS Lemoore, principally **E4** to **E9**, in AE and AM ratings.

The sample was designed to be broadly representative of **NAESU** customers. We were unable to attain a fully representative sample. Additional respondents from all categories and more diverse locations are needed to increase the ability to generalize the data.

RESULTS

Some of the information developed in the previous study (Boynton, 1995) is relevant to and included in this study. We commented that performance measures of tech rep organizations might encompass areas not typically thought of as tech rep activities, but which added to the overall value to DOD. One example was the Army Logistics Assistance Program, which reported a cost avoidance of nearly \$85 million in 1994. Army tech reps regularly visited local units of the Defense Reuse Organization and reclaimed items that they knew, through experience and networking, could be used by their own or other organizations. In the same vein, we commented that lack of experience among military technicians, base closures, unit relocations, and changes in mission equipment cause much turbulence that increases the likelihood of significant costs unless tech reps are present.

Tech reps also reported proposing maintenance procedure changes that resulted in very large savings in dollars, technician time, and equipment. Even though the primary responsibility of tech reps is training, these other activities contribute greatly to their overall value. Performance measures should take cognizance of these seemingly peripheral activities.

Customers and tech reps cited many instances of gaps in the logistics systems that generate the requirement for tech rep involvement. Operational requirements commonly take precedence over training and development activities. Modifications are made to equipment without full training and documentation being provided with the modification. Senior personnel are not familiar with the equipment. Basic schools, advanced schools and introduction of new equipment are not synchronized. Equipment is not designed for ease of operation and maintenance or modification. Military units lack a full complement of qualified personnel. Travel funds are not available to send personnel to advanced service or factory training. Built-in test equipment fails to provide appropriate information to personnel. These gaps are so serious that Colon (1994), in his Naval Postgraduate School thesis, recommended ETS be added as the eleventh ILS element.

The intimate equipment and process knowledge and continuing contact with operations and maintenance place the tech rep in a unique position to develop recommendations for improvement. Malcolm (1995), in his Naval Postgraduate School thesis, developed a procedure

for Determining the tangible cost savings through improvements to the reliability and maintainability of aircraft weapon systems that resulted from NAESU technical reports. His analysis showed that some technical reports precipitated fleet-wide changes that resulted in significant cost savings. He recommended development of a computer program to track the effects of NAESU technical reports on a continuing basis.

Our interviews, with personnel at all levels, provided examples of significant cost avoidance as a direct result of tech rep actions on a local level. Cost-avoidance is very attractive as a measure of NAESU and tech rep value. To be able to cite examples of cost-avoidance that far exceed the annual cost of maintaining a tech rep is a strong incentive. It has, however, serious deficiencies. Improvements in the maintenance procedures used by military technicians have resulted in savings of money, time, and parts. One NAS estimated it would cost \$47,000, per quarter, to bring instructors to the station to perform the classroom training provided by the NAESU DET. Such cost-avoidance, however, is not a consistently reliable measure of NAESU performance. It assumes that the same training would have been conducted by some other means.

Since funds are seldom available to conduct all desirable training or to send technicians to schools or factory training, it is likely that much training would not have happened. The real value is the increase in capability of the military technicians as a result of training provided by NAESU. That capability increase, however, cannot be evaluated in dollars.

During interviews, tech reps cited instances in which they were able to make significant savings by repairing items locally rather than sending them to depots. Items are normally sent to the depot when it is beyond the capability of the organization to repair the item (BCM). The standard cost, which may be several thousand dollars, is incurred whether the item requires major repair, minor repair or was misdiagnosed and needs no repair. The tech rep may provide a correct diagnosis or on-site repair, avoiding the time and cost of sending equipment to the depot. The cost avoided frees the funds for the purchase of spare parts, fuel or other uses and does not usually show up as a savings. In many cases, there is no clear way to determine whether the problem might have been solved without the intervention of the tech rep. The tech rep is in the best position to make such determination, but is also the one who receives credit for the cost-avoidance. It is therefore difficult to use such a measure on a regular basis.

Some cost-avoidance situations are much more clear-cut. At one Naval Air Station, a tech

rep determined that the test benches were not properly grounded. This resulted in good items testing as faulty and significant depot costs to repair and calibrate the test benches. The unnecessary cost and delay were eliminated when the grounding was corrected. Depot costs were subsequently reduced by over \$23,000 per month. Comparable savings occurred at other Naval Air Stations when similar problems were corrected.

Due to extensive knowledge and experience, a tech rep may determine that an engine problem can be repaired in place. This avoids the cost of dropping and replacing the engine and returns the aircraft to full flight status more quickly. In the process the tech rep also instructs the military technicians, bolstering their knowledge and reducing future incidents. The increase in the technicians' skill and knowledge then represents cost savings in the future, but are not readily and confidently measured.

When asked, "*What measures indicate the level of performance you are attaining on the job?*" NAESU tech rep responses included:

- The attitude of the military technicians and others they work with. This encompasses feedback, the apparent opinion of the low level technicians, rapport, instant recognition and credibility of the NAESU symbol, and a feeling that the customer is satisfied.
- Specific comments and thanks received, including tech assist reports letters of appreciation, and customer comment sheets.
- The fact that sailors and marines seek out the tech reps and request repeat visits.
- The apparent increase in the military technicians' proficiency. How they are performing, their ability to solve problems after training, and not receiving calls when a unit is on deployment, are examples of this.
- Some aspects of time enter here. One could measure how long it takes military technicians to solve a problem before and after training, the number of hours spent on various tasks, and the spectrum of daily activities.

Their replies to the question "*How do your activities add value to your organization's output of goods and services?*" included:

- Outcomes, such as an increase in the number of Full Mission Capable (FMC) aircraft, a decrease in partially mission capable aircraft, better trained sailors, repair equipment and test benches that work and stay up, regularly providing input for safety of flight

decision, and readiness increases, are indicative of value added.

- Resource savings, including reducing depot repair requirements and not having to send military technicians away to school. Cost savings can also result from development of new test and maintenance procedures, as well as obtaining usable equipment from the Defense Reuse Organization.
- Reassuring officers by providing a second qualified opinion legitimizing the work of the military technicians. Making the technicians' work easier. Avoiding downtime due to knowledge of recurrent problems from other units.

While conducting the ETS discussions, we began interviewing a small number of customers. We posed questions that paralleled those asked of ETS. Customers viewed tech reps as another resource to get aircraft and equipment fully mission capable in the shortest time possible and to keep them that way. Readiness was viewed as the real value of NAESU and tech reps.

Tech reps affect readiness by providing training to military technicians, by developing maintenance procedures, by clarifying manuals, and occasionally by direct repair of a problem. Other things also affect readiness and may include the quality of training provided by the service schools, the availability of spare parts, up-to-date equipment documentation and test equipment. Such things as organization manning, the extent to which personnel are experienced and qualified for the assigned equipment, the reliability and maintainability of the equipment, and the amount of inspections and other duties that take people away from operating and maintenance also impact readiness. There is no way to apportion the tech rep contribution to readiness in isolation from the other factors.

One way to measure the readiness impact of tech reps might be to conduct a controlled experiment, allowing some squadrons to use tech reps but not others. It is unlikely that squadron commanders would agree to participate in such a study, since the readiness numbers are a major factor in their performance evaluations and thus their promotion possibilities. Readiness numbers are also subject to a certain amount of manipulation and many of our interviewees consider the reported readiness figures to be unreliable. While readiness is clearly the outcome sought, it can not be reliably measured and has few, if any, acceptable proxies.

As measures of the quality of ETS performance, the tech reps suggested report cards evaluating ETS timeliness, responsiveness to requests, approachability and professional

appearance.

Graph 1 displays average customer expectations taken from the questionnaire we asked clients and users to complete. Under the category of "Service Expected" (from NAESU), we asked them to use ratings of "Primary", "Secondary/Incidental", or "None". These were later coded as 3, 2 and 1 respectively and used to calculate the average expectancies. Clients rated "Provide OJT" as the service they most expected. "Conduct off-site tech assists", "Advise on safety/maintenance concerns" and "Provide classroom training" were the next three most highly rated. Users rated "Identify fleet/systemic problems" highest; with "Provide feedback to training community", "Develop improved maintenance techniques" and "Advise on safety/maintenance concerns" as the next highest, "Conduct off-site tech assists" and "Provide OJT" were also highly rated.

Graph 1 indicates that clients and all categories of users are largely in agreement regarding their expectations from ETS. Although there are exceptions, a product or service rated high or low by one group is also rated high or low by the other groups. The exceptions raise some interesting questions about the primary expectations from ETS. For example, clients and senior users place high expectations on the provision of OJT and classroom training, while O and I level users have lower expectations. The statistical significance of these differences cannot be tested due to sampling and scaling problems.

In order to examine the extent of overall agreement, the average expectations were converted to ranks. Table 1 shows that there is wide agreement on some services and products, but not on all. On OJT and classroom training, clients and senior users provide high ranks. "O" and "I" level groups, however, rate them in the bottom half of the activities. How closely the customer groups agree may be indicated by the correlation of the four sets of ranks.

Table 2 provides the correlation coefficients for the rank orders of the four customer categories, clients, senior users, "I" level users, and "O" level users. There is much higher agreement, $r = .902$, between the clients and senior users than the other groups. This helps to confirm what was noted in Graph 1.

Service/Product	Customer Type 4 (Square)	Customer Type X (Diamond)	Customer Type Triangle (Circle)
CLSRM T	2.75	2.75	2.50
SAFMNT	2.75	2.75	2.50
WPKRND	2.75	2.75	2.50
ILS RW	2.75	2.75	2.50
DSGN RW	2.75	2.75	2.50
EI INVT	2.75	2.75	2.50
EMGY RPR	2.75	2.75	2.50
TECH ASST	2.75	2.75	2.50
LAS/COORD	2.75	2.75	2.50
STATUS RPT	2.75	2.75	2.50
SUPLOG	2.75	2.75	2.50
PUBS/DATA	2.75	2.75	2.50
BLD EQP	2.75	2.75	2.50
MODS/MP	2.75	2.75	2.50
TRNG FBK	2.75	2.75	2.50
CBM ADVICE	2.75	2.75	2.50
IMP TECH	2.75	2.75	2.50
SYS PROBS	2.75	2.75	2.50

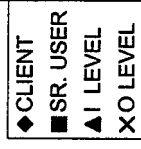


Table 1.
Rank Order of Service Expectations by Category of Respondent

Type Of Service	Client	Senior Level User	"O" Level User	"T" Level User
1. Provide OJT	1	1	9	11
2. Provide Classroom Training	4	3	12	11
3. Advise On Safety/Maintenance Concerns	2	3	3	7
4. Advise On Maintenance Work-Arounds	11	14	1	4
5. Participate In ILS/TPF Reviews	12	11	17	10
6. Participate In Pre-Design Reviews	17	15	15	16
7. Participate In E.I. Investigations	14	16	11	9
8. Provide Emergency hands-on Repair	14	7	10	16
9. Conduct Offsite Tech Assists	3	2	7	4
10. Provide Liaison And Coordination	10	10	4	6
11. Report On Equipment Status	17	16	18	18
12. Provide Supply/Logistics Assistance	16	19	16	15
13. Update/Verify Tech Pubs And Data	7	11	14	8
14. Design/Build Peculiar Test Equipment	19	16	19	18
15. Recommend Mods/Improvements	5	7	5	11
16. Provide Feedback To Training Community	7	6	8	1
17. Advise on Condition Based Maintenance	13	13	13	14
18. Develop Improved Maintenance Techniques	7	7	6	3
19. Identify Fleet/Systemic Problems	5	5	2	1

Table 2
Pearson Correlation of ranks of expectations by customer type

<i>Customers</i>	<i>Client</i>	<i>Senior Level User</i>	<i>"T" Level User</i>	<i>"O" Level User</i>
Client	1.000			
Senior Level	0.902	1.000		
"T" Level	0.653	0.562	1.000	
"O" Level	0.658	0.511	0.765	1.000

The O and I level technicians are the most directly affected by the principal tech rep actions. The lower correlation coefficients indicate that the views of clients and senior users are not fully representative of the military technicians concerns. This implies a need to include all four customer types in future measurements.

DISCUSSION AND RECOMMENDATIONS

One of the major aims of the previous project was to enroll customers and ETS in the task of finding measures of performance for ETS and their organizations. An earlier NAESU Customer Service Improvement survey attempted to measure some of the important areas of service provided and quality level achieved. The perceived quality was quite high, with 99% of a broad spectrum of customers agreeing with the statement that "ETS services received within the last year were satisfactory." Development of performance measures to support that perception, however, has proved to be a significant challenge to both practitioners and academics. We discovered no particularly useful measurement methods currently in use, either by NAESU Detachments or other organizations providing similar services.

At one point, NAESU established a task-hour reporting system to provide data on what tech reps actually do on a continuing basis. The task-hour reporting system did not provide useful data and has since been abolished. It should be noted that the amount of time spent on an activity may not be indicative of its importance.

In this study, we used a list of tech rep products and services and asked various groups of users and tech reps to cluster them. They were given no guidance as to the number or types of clusters to be used, but simply asked to group together those activities that seem to go together. Consistent clusters would indicate a natural grouping of activities that could form the basis for aggregation of individual measures that would facilitate development of proxy measures for tech rep performance. Consistency of clusters under these circumstances was too much to hope for. To generalize, the principal clusters of products and services are Training, Liaison, Advice, and Maintenance. These may provide a basis for NAESU to survey users regarding the overall performance quality of each DET.

A recent book by Sveiby discusses intangible assets. "Knowledge is a key intangible asset and the ability to transfer knowledge from one person to another is a key business capacity." In dealing with intangible assets, there are no specific tasks to measure. This characterizes the work of ETS. Management of intangible assets can be considered as having three aspects, the competence of the employees, the internal structures (e.g., systems and processes), and the external structures (e.g., customer relations, supplier relations, and organization image).

Quality is ultimately defined by the customer's perception. Tech reps, as the principal providers of NAESU goods and services, must do so in a manner that meets the customers' expectations. This implies delivering the right services at the right time. The role of the NAESU organizational components then is to assure the continuing Competence of ETS and to provide the internal and external structures that enable tech reps to provide those products and services.

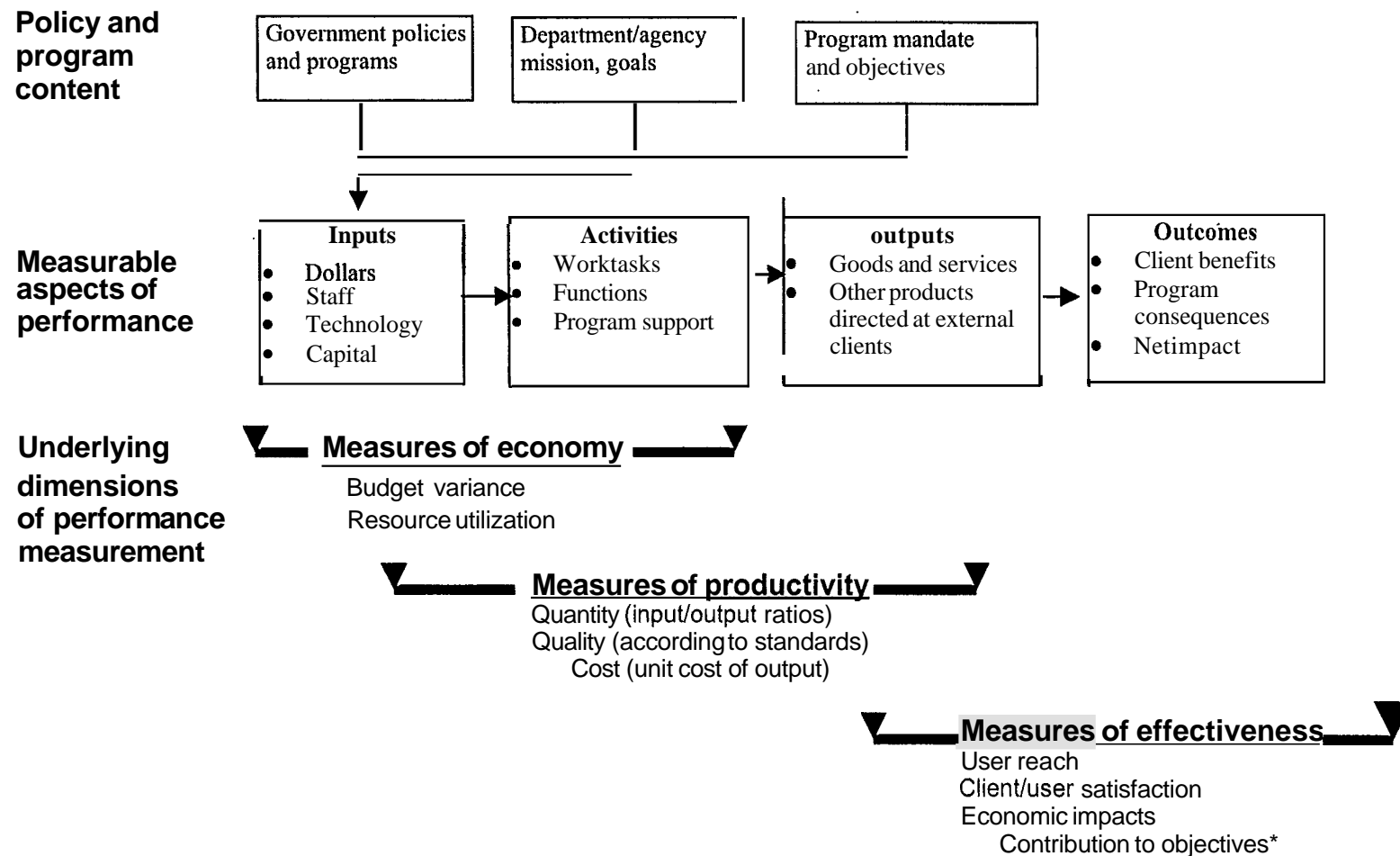
- Is NAESU responsive to customers' needs, wants, wishes, and requests?
- Does it research customer desires, anticipate them, and plan ways to meet them?
- Does NAESU provide opportunities and resources for its tech reps to develop their individual competence and teamwork?
- Does NAESU facilitate the interactions of tech reps and their customers and suppliers?
- Does the image of NAESU positively affect the tech reps work?

GAO report GGD-98-137, although developed for Grant Program design features, provides a model of aspects of performance that seem appropriate to a service organization such as NAESU. Figure 2, taken from the report, is based on "OMB documents prepared to assist agencies in meeting ... performance measurement requirements."

It identifies four aspects of performance - inputs, activities, outputs, and outcomes - each representing a major step in the process of converting program resources into program results. Referring to Figure 2, it would seem that measures of economy and measures of effectiveness could be developed for NAESU. Measures of productivity, however, would be very difficult and arbitrary. Production units of input and output, required to develop input/output ratios, are not definable in this kind of intangible, knowledge-intensive environment. Standards do not exist for the type of problem solving work performed by NAESU and teaching standards apply more to schoolhouse environments, with a set clientele and curriculum, than to on-the-job and ad hoc situations in which much NAESU training is conducted. On the other hand, client reach, customer satisfaction, economic impact and contribution to objectives can be addressed.

RECOMMENDATION 1. We recommend that NAESU inform NAVAIR that the measures of productivity are not meaningful for NAESU. It should request that NAVAIR exempt it from productivity measures.

Figure 2: Performance Spectrum and Measurement *



- Modified and adapted from GAO report GGD-98-137
-

RECOMMENDATION 2. We recommend that a pilot study be undertaken in FY 1999 to develop and validate a survey instrument for future use.

RECOMMENDATION 3. We recommend that NAESU take random, unbiased samples of the customer population. The sample should be taken at least every six months and should focus on the quality of NAESU service in the four broad categories of training, liaison, advice and maintenance. The sample should include the four categories of NAESU customers, i.e. clients, senior users, “I” level users and “O” level users. The survey should look for a few simple indicators that can be aggregated to address the quality of service provided by NAESU by DET, Region, and overall. Over time, the survey should lead to the development of a data base that facilitates identification of problems and provides an indication of whether the problems are short term (one time or temporary), long term or possibly systemic changes in NAESU effectiveness.

RECOMMENDATION 4. We recommend that the survey include the areas of timeliness, responsiveness to requests, approachability, customer reach, and customer satisfaction. It should include opportunity for open-ended responses for cost-avoidance and procedural recommendations.

RECOMMENDATION 5. We recommend that NAESU address customer and task uncertainties by continuing the annual on-site ETS reviews.

RECOMMENDATION 6. We recommend that a separate sample survey of tech reps be taken every six months. It should include their job satisfaction, work environment, developmental needs and organizational support.

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APPENDIX: LISTS AND FORMS

The five exhibits attached to this appendix trace the development of the lists of ETS activities.

79 ETS ACTIVITIES

An initial list of 17 activities was developed from conversations with tech reps. This list was used in a questionnaire for tech reps and customers. They were requested to add any other activities they felt to be important. Customers added 26 items and tech reps provided 36 more. These were added to the original 17 without editing for duplication or relevance.

ACTIVITY CLUSTERS

The 79 activities were sorted into groups or clusters by six groups of NAESU ETS and DET OICs. The clusters were named by the groups.

28 ETS ACTIVITIES

Elimination of duplications, very minor activities, and those that were not tech rep activities resulted in a list of 28 activities.

19 ETS ACTIVITIES

This list resulted from consolidation of activities and removal of those that did not provide an output good or service.

ETS SURVEY FORM

The **19** activities were used in this questionnaire. It is the basis for evaluating customers' expectations from NAESU.

79 ETS ACTIVITIES

Items 1-17 are the activities of ETS/LARS used in the survey questionnaire. In response to an open "other" line, activities 18-43 were added by customers and 44-79 by ETSILARS.

ACTIVITIES LISTED ON THE QUESTIONNAIRE

1. Provide OJT
2. Provide classroom training
3. Liaison/Coordination
4. Report on equipment status
5. Advice on Personnel or Management
6. Update/verify tech pubs/data
7. Design/Build peculiar test equip
8. ILS/TPF Reviews
9. Pre-design reviews
10. Investigate EIs as Tech Advisor
11. Actual hands-on maintenance
12. Supply assistance
13. Recommend mods/improvements
14. Administration/paperwork
15. Off-site tech assists
16. Organization-initiated Education/Development of tech rep's own skills
17. Self-initiated Education/Development of tech rep's own skills

ACTIVITIES ADDED BY CUSTOMERS

18. Maintenance direction/advice
19. Course development
20. Continuity
21. Networking
22. In-depth knowledge and experience
23. Equipment repair continuity
24. Systems history knowledge
25. Ability to provide AF-level systems support
26. Corporate knowledge
27. Provide assistance to "O" level customers
28. Advice on safety related items/maintenance concerns
29. Advice on work-arounds to maintenance
30. Advice on trouble shooting accuracy
31. Advice and concerns
32. Training raw recruits
33. Trouble shooting beyond, or not covered by, tech nianuals
34. Provide feedback to training community
35. Resident expert
36. Continuity
37. Depot engineering contacts
38. Company contacts
39. Enthusiasm to accomplish missions
40. Importance of prior military service
41. Proficiency of machinery
42. Knowledge of systemis
43. Recommendations for Condition-Based niaintenance

ACTIVITIES ADDED BY ETS/LARS

44. NG/USAR liaison visits
45. Safety of equipment
46. Evaluate unit/system readiness
47. Supply assistance
48. New equipment fielding
49. Assisting with supply problems
50. Very instrumental in getting this program restarted
51. Represent unit at product improvement groups and conferences
52. Devise non-typical repairs in wartime scenario
53. Technical assistance
54. Daily help
55. Supervision of other employees (75% to 25%)
56. Equipment verification
57. CSRA/reviews/inspections
58. Coordination of FITWING/NAESU training (IWSR, advanced training, etc)
59. Education of the military into the potential of having personnel trained to provide training and continuity
60. Helping units solve problems
61. Vendor liaison
62. Mobilization (Guard and reserve)
63. Revalidation (Guard and reserve)
64. Logistics/transport/tracking
65. Acquiring needed hardware from CECOM
66. Maintenance technique improvement
67. Local equipment logistics assistance
68. Subordinate work-skill improvement
69. Detachment administration interface
70. Providing technical guidance to other personnel
71. Identifying fleet problems/systems
72. Verify and feedback report PMS
73. Tech assist air travel
74. Meetings (PMR)
75. Factory training
76. Maintain "MAMS" spare parts for trouble shooting and fault isolation
77. Other tasks besides technical
78. Liaison with other groups on EW
79. Working military operations

ACTIVITY CLUSTERS

Participants in the August 1994 NAESU OIC conference were divided into 6 groups (about 6 persons/group) and asked to group or cluster the 79 ETS activities. They were then asked to name their clusters as they reported back to the whole group.

- GROUP1

1. Tech Assists: 53 15 22 54 70 71 76 79 27 11 60 33 35 18
 2. Training: 2 19 42 66 32 75 1 58 59
 3. Field Engineering Feedback: 7 46 51 58 52 56 4 41 72 10 13 45 6
 4. Advice: 31 **30** 29 28 5 43
 5. Supply: 12 64 65 67 47
 6. Liaison: 3 36 61 44 49 20 **34** 21 78
 7. Reviews: 8 37 38 26 74 57 40 9
 8. Administration: 14 73 55 68 17 16 77 69
 9. Reserves: 63 62
- Throw Away: 25 50 39 23

- GROUP2

1. Training: 32 1 66 75 19 59 68 2 58 34 11 17 16
 2. Supply assistance: 49 47 64 67 12 76 65
 3. Knowledge/Tech Assist: 22 42 35 41 24 27 71 73 15 4 33 43 52 40
 4. Liaison/Continuity/Design Review: 36 45 25 50 69 78 9 56 6 7 48 8 51 13 57 72 14
 5. Advice: 29 18 70 30 53 28 54 10 31 60 5 46
- Throw away: 55 37 62 63 79 77

- GROUP3

1. Training: 2 19 32 68 22 24 42 35 16 75
 2. Tech Assist: 11 15 27 1 18 30 33 28 43 52 53 54 59 60 66 70 71 7 10 23 29
 3. Logistics: 47 49 64 65 67 76
 4. Administration: 5 14 55 69 77
 5. Feedback/Reporting: 38 37 3 44 61 20 26 17 21 74 23
 6. Conference/review: 8 9 51 57 6 4 41 45 46 48 13 56 72 34
 7. Liaison: 3 20 26 37 38 44 50 58 61 74 **78**
- Trash: 63 40 39 79 73 12 36 25 62 31

- GROUP4

1. Liaison: 3 4 18 28 29 31 34 21 37 38 43 44 12 47 49 61 65 69 78 36
2. Maintenance: 11 23 41 52 76
3. Quality Assurance: 6 8 10 45 64 67 71 72 74 4 7 9 13 14 46 48 51 56 57
4. Training: 2 1 15 16 17 19 25 27 30 32 53 54 58 59 60 66 68 70 75 77 39
5. Experience: 20 22 24 26 33 35 40 42
6. Other: 55 73 79 62 63 50

- GROUP 5

1. Provide OJT: 1 15 27 11 29 32 52 54
2. Provide classroom training: 2 19 58 59 66 68 70 75
3. Liaison/Coordination: 18 31 5 37 38 44 50 61 78
4. Proficiency of Machinery: 45 23 56 28
5. Resident Expert: 20 21 24 22 26 33 40
6. Supply Assistance: 49 64 65 67 76 4
7. Administration/Paperwork: 55 69 17 39 16
8. Recommend Mods/Improvements: 34 10 72 25
9. Technical Assistance: 60 71 73 79 62 63
10. Other Tasks besides Technical: 7 43 46
11. ILS/TPF reviews: 6 9 48 51 57 74

- GROUP 6

1. Training: 45 41 60 54 59 53 33 32 30 29 28 70 68 27 25 22 19 18 2 1 15
 2. Liaison: 8 5 7 6 1 6 4 6 7 7 2 3 6 5 1 2 9 1 3 2 1 4 7 4 9 5 8 7 4 3 4 5 3 1 7 8 4 4 4 3 7 1 4 6 5 1 3 7 3 8
 3. Administration: 77 73 69 14 55
 4. Research: 6 10 48 56 4 66 52 7
 5. Hands-on Maintenance: 76 11
 6. Personal Management/Improvement: 75 17 16
 7. Continuity of Corporate Knowledge: 42 40 36 35 26 24 23 20
- Unknown: 39 50 79 63 62

28 ETS ACTIVITIES

1. Provide OJT
2. Provide classroom training
3. Liaison/coordination
4. Report on equipment status
5. Advice on personnel or management
6. Update/verify tech pubs/data
7. Design/build peculiar test equip
8. ILS/TPF reviews
9. Pre-design reviews
10. Investigate EIs as Tech Advisor
11. Actual hands-on maintenance
12. Supply/logistics assistance
13. Recommend mods/improvements
14. Administration/paperwork
15. Off-site tech assists
16. Organization-initiated Education/Development of tech rep's own skills
17. Self-initiated Education/Development of tech rep's own skills
18. Maintenance direction/advice
19. Advice on safety related items/maintenance concerns
20. Advice on work-arounds to maintenance
21. Advice on trouble shooting accuracy
22. Trouble shooting beyond, or not covered by, tech manuals
23. Provide feedback to training community
24. Recommendations for Condition-Based maintenance
25. Maintenance technique improvement
26. Providing technical guidance to other personnel
27. Identifying fleet/systemic problems
28. Working military operations

19 NAESU ETS ACTIVITIES

1. Provide OJT
2. Provide classroom training
3. Advise on safety/maintenance concerns
4. Advise on maintenance work-arounds
5. Participate in ILS/TPF reviews
6. Participate in pre-design reviews
7. Participate in EI Investigations
8. Provide actual hands-on maintenance
9. Conduct off-site tech assists
10. Provide liaison/coordination
11. Report on equipment status
12. Provide supply/logistics assistance
13. Update/verify tech pubs/data
14. Design/build peculiar test equip
15. Recommend mods/improvements
16. Provide feedback to training community
17. Advise on Condition-Based maintenance
18. Develop improved maintenance techniques
19. identify fleet/systemic problems

NAESU ETS ACTIVITIES

- [illegible]

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